

PART III

PHYSICAL DESCRIPTION

Physical Regions of Washington

On the basis of surface features, Washington may be divided into eight general regions. Agricultural settlement is influenced by factors of topography, climate, soil, forest vegetation, and water resources distinctive to each of the physiographic regions. Each has become a different type of farming area as settlers have learned to adapt crops and livestock to the conditions or have improved limitations through drainage or irrigation.

Coastal Plains

A narrow, sandy plain with shallow bays, tidal flats, stream deltas and low headlands lies between the coastline and the Coast Range. It extends from the Columbia River mouth almost to Cape Flattery, being widest and lowest in the Grays Harbor and Willapa Bay districts. The climate is mild and damp with a long growing season, but it is too cool, cloudy and wet for most crops. Originally, this area was covered with heavy forests but much of it is now covered with woodlands. Lumbering and manufacture of wood products is the main industry. Farming is largely livestock and dairying on low uplands and drained areas in the lower Chehalis River Valley. Cranberry growing is important and well-adapted to numerous, boggy areas in the Grays Harbor and Willapa Bay sections. The shallow bays are also used for oyster culture. Fishing is common in the rivers and coastal banks.

Coast Range

The Coast Range is an uplifted area of sedimentary and metamorphic rocks divided into the Olympic Mountains and the Willapa Hills. The Olympics tower to nearly 8,000 feet in a dome-like structure, carved deeply by rivers. These mountains have the heaviest precipitation in the state. Snowfields and heavy forest cover the mountains. Most of the wilderness area is within the Olympic National Forest and Olympic National Park, being managed for recreation, wildlife and timber. Farm settlement is limited to some foothill river plains and coastal terraces such as the Dungeness and Port Angeles districts along the Strait of Juan de Fuca. Here in the lee of the mountains, rainfall is moderate and irrigation is practiced by some livestock farmers. The Willapa Hill country is wet, heavily forested and carved into numerous narrow valleys. Logging is the main industry, combined with livestock farming in the upper Chehalis River Valley and along the banks of the Columbia River. Wet climate, hilly topography and the difficulty of clearing stump land retards agriculture.

Willamette-Puget Sound Lowland

A broad lowland, described as a trough or valley, lies between the Coast Range and the Cascade Mountains. The northern part is the Puget Sound Lowland which has been glaciated and is occupied by the sea in the lowest sections. The continental glacier reached slightly south of Olympia. Under a warming climate it melted and geologists believe it receded about 25,000 years ago, leaving an infertile plain of moraines and outwash gravels, sands and clays known today as the Puget Glacial Drift Plain. Its rolling surface has numerous lakes and bogs.

Most of the major cities--Seattle, Tacoma, Everett, Bellingham and Olympia--have been built on moraines bordering the Sound. Rivers such as the Nooksack, Skagit, Snoqualmie, White and Puyallup have built up deltas and flood plains over the older gravelly plains. These narrow valleys are more fertile than the older glacial plains and support numerous small dairy, vegetable and berry farms. Most of the gravelly areas are wooded with a second-growth forest and are used for pastures. In the southern part of the Willamette-Puget Sound Lowland, there are two large valleys--the Cowlitz and Chahalis. They drain a low, hilly area with several flat prairies and bottom lands.

Agriculture is handicapped by poor drainage and flooding of the river deltas and plains, by heavy winter rainfall, by cloudy but dry summers, by coarse, gravelly upland soils and by densely wooded land which is costly to clear. Advantages are mild climate and a location close to major markets for farm products such as milk, poultry and vegetables.

Cascade Mountains

The Cascades are a wide and high topographic and climatic barrier which separates western and eastern Washington. The range is made up of sedimentary, igneous and metamorphic rocks which have been carved by glaciers and streams. High, isolated volcanic cones of lava such as Mt. Adams (12,307 feet), Mt. Rainier (14,408 feet), and Mt. Baker (10,791 feet), appear upon the older Cascade rocks. The Cascade crest varies between 10,000 and 3,000 feet and is higher and more rugged in northern Washington. Roads and railroads have been built across its lower passes in central and southern Washington. The Columbia River has cut a deep gorge and the lowest pass through the barrier. The western slope is wet and heavily forested with Douglas fir. The eastern slope is drier with a less-dense pine forest. Nearly all classified as forest land, most of the area is in Federal ownership in five national forests and Mount Rainier National Park. Tree fruit farming in the eastern slope valleys of Wenatchee, Chelan, Methow, Naches and the Columbia Gorge is most important. Sheep and cattle summer grazing on alpine grasslands is another use. Deep western slope valley bottoms such as the Skagit, Snoqualmie, Nisqually, Cowlitz and Lewis also contain livestock farms. The area is vitally important as a source of water for irrigation and city drinking water and as a source of timber. Steep terrain, wet climate, short growing seasons and heavy forest vegetation are main handicaps for agriculture.

Columbia Basin

A low plateau of old lava rocks covered with stream and wind-deposited soils extends in a series of plains, ridges, coulees and hills from the Cascades to the eastern Washington border. The area is basin-like in structure, being higher around its margins and sloping inward to low and level central plains. It has been sharply eroded by the Columbia River and its interior tributaries, the Snake, Yakima, Palouse and Spokane Rivers. The basin has sub-areas created by crustal movements and erosion.

- A. The Yakima Folds are a series of hilly ridges extending from the Cascades eastward into the lower part of the basin. The Yakima and Columbia Rivers have cut gaps through the ridges, and built up plains in the troughs between them. The rich, alluvial plain of the Yakima River is an important irrigated valley.

B. The Waterville Plateau is a tableland of thin soils overlaying basaltic rock at an elevation of 2,500 to 3,000 feet. It has gorges cut by the Columbia River and ancient glacial outwash streams once flowing in Moses and Grand Coulees. It is too high for irrigation and is used for dryland grain and livestock farming. The high plain is often called the Big Bend Country.

C. The Channelled Scablands is a belt of dry terrain carved by ice-age rivers into a series of coulees. Bare rock is exposed in the coulees. Small plateaus between the old river channels have thin soils used for dryland farming. The Grand Coulee of this region has been developed into a major irrigation reservoir.

D. The Palouse Hills consist of fertile deposits of wind-blown soil overlaying basaltic lava flows. After being deposited in large dunes, the formation was reshaped by streams into an intricate pattern of low, rounded hills which are tilled for wheat, barley and legumes. The hills receive 16 to 25 inches of rainfall annually and are composed of deep, porous and fertile soils. It is one of the richest farming areas of the Pacific Northwest.

E. The Central Plains are low and relatively level expanses of soil, deposited by old streams crossing the Channelled Scablands and later by the flooding of the Yakima, Columbia, Snake and Walla Walla Rivers. Climate is desert-like (6-12 inches of precipitation per year). The lower lands of the area, the Quincy and Pasco Basins and the Walla Walla Valley, are irrigated. The Quincy Basin is a new irrigation area watered by Grand Coulee Dam.

Agricultural handicaps in Columbia Basin regions are mainly found in its dry, continental climate. Large irrigation systems built since 1900 have overcome much of the need for water on rich valley and basin soils. Dryland farming in higher areas is practiced widely, although occasional variations in rainfall, lack of snowfall, winterkill, water and wind erosion inflict damage to field crops and to livestock ranges.

Okanogan Highlands

A portion of the Rocky Mountains, consisting of well-eroded old granites, lavas and sedimentary rocks extends across north-central Washington. These are the Okanogan Highlands, the state's richest mineral area. Summit levels reach 4,000 to 5,000 feet with peaks exceeding 7,000 feet. Prominent north-south valleys are occupied by irrigated tree fruit and livestock farms. These are the Okanogan, Sanpoil, Kettle and Colville Valleys. The Columbia River gorge through the Okanogan Highlands is occupied by the large man-made lake behind Grand Coulee Dam--Roosevelt Lake. Higher and wetter portions are forested with pine and larch and are managed for timber and for livestock ranges by the United States Forest Service and the Bureau of Indian Affairs. Cold winter temperatures, short growing seasons, dry valley climates and distance from markets are farming handicaps.

Selkirk Mountains

The Selkirks, a range of the Rocky Mountain system, extend into the northeast corner of Washington. The rocks are old, mineralized granites and metamorphics reaching elevations of over 7,000 feet. The Pend Oreille River Valley at the

base of the Selkirks is an agricultural area of narrow bottom lands settled by livestock farmers. Nearly all of the uplands are in Kaniksu National Forest. While climate is cool and growing seasons are short, the Pend Oreille Valley has an advantage of being closely located to the Spokane metropolitan market area.

Blue Mountains

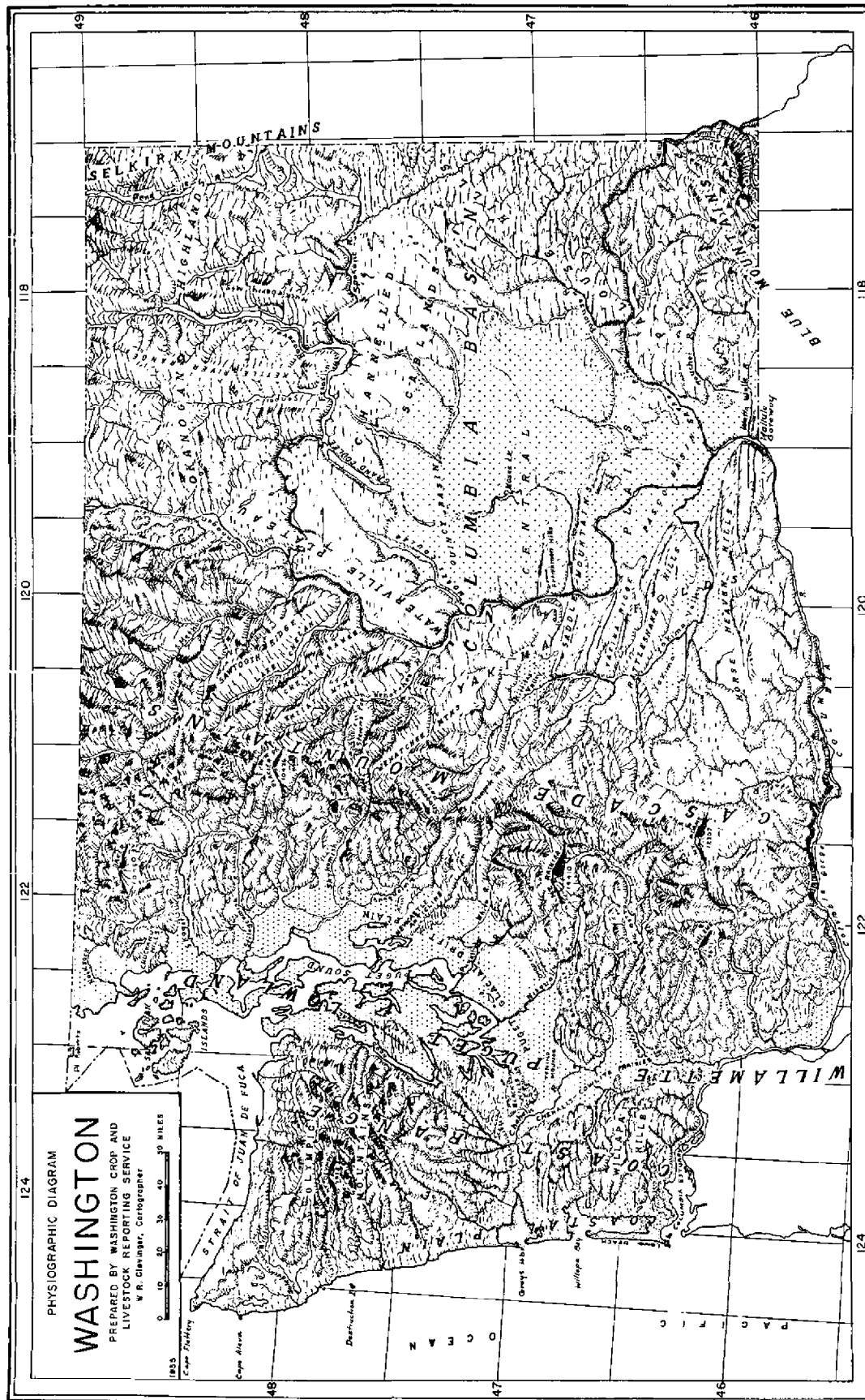
The Blue Mountains are an uplifted and eroded plateau extending into the southeastern corner of Washington. The strata are mainly ancient crystalline rocks which contain some minerals. The highest point of the mountains in the Washington section is Diamond Peak (6,401 feet), located on the divide between the Grande Ronde, Tucannon and Touchet Rivers. These rivers, and the Walla Walla River, have cut valleys into the plateau. Extensive pine forest and grassland areas are in the highlands within Umatilla National Forest, where rainfall is 30 to 40 inches. The Snake River has cut a deep valley and gorge across the lower parts of the mountains. The area is well developed agriculturally around its northern foothills where wind-blown soils are deep and irrigation systems are used. The Walla Walla and Tucannon Valleys are rich grain, legume and livestock areas of irrigation and dry farming. Grazing is an important use of the highlands by livestock ranchers in the upper valleys.

Topography of Pend Oreille County

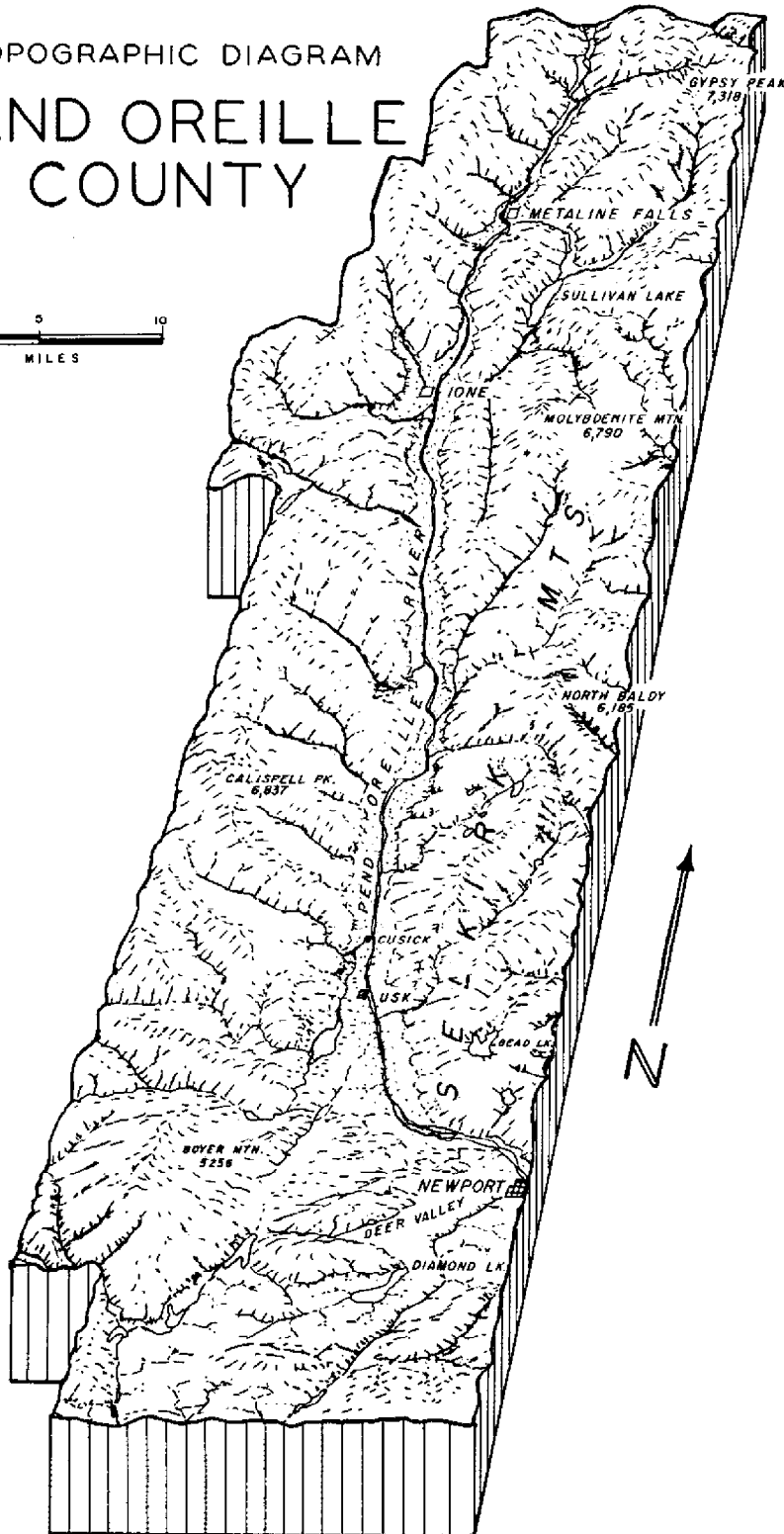
Pend Oreille County is situated entirely within the Okanogan Highland physiographic region--a portion of the Rocky Mountains which extends across northeastern Washington. The topography varies from the relatively flat, lowland valley of the Pend Oreille River to the rough, hilly and mountainous terrain in the Selkirk Mountains and Okanogan Highlands which flank the valley. The present surface of the county is the result of ancient mountain building, glaciation during the Ice Age and subsequent stream erosion and deposition by the Pend Oreille River and its tributaries. Mountains, largely forested and unsuited for agriculture, make up over three-fourths of the total area. Elevations in the mountains range between 2,500 and 7,300 feet. The highest point is Gypsy Peak, elevation 7,318 feet, located in the northeastern part of the county within Kaniksu National Park. The structure of the mountains is complex, consisting of sedimentary rocks with extrusions of ancient igneous rocks. Northern Pend Oreille County in the Metaline Falls district is endowed with numerous deposits of lead and zinc. Limestone also is found in the area. Over the years, this part of the county has been one of the state's leading mining areas.

Pend Oreille County's agriculture is primarily confined to the glacial and alluvial plains and the lower benchlands of the Pend Oreille River. The Pend Oreille River valley is long and narrow. It extends from Newport where the river enters the county from Idaho northward to the Canadian border. Valley elevations range from 2,075 feet near Newport to 1,900 feet in the gorge of the river at the Canadian boundary. Geologists believe that during the Pleistocene glaciation period, the Pend Oreille River drainage to the north was blocked by the receding continental ice sheet which covered most of present northern Washington. During this period, a large lake was formed covering most of the Pend Oreille valley and the river was diverted southwestward through Deer Valley into the headwaters of the Little Spokane River. Fine clay sediments were deposited in the lake creating the flat plains known today as Cusick Flats and Calispel Valley.

A similar lake bed plain was created in the valley between Ione and Blueslide. The lowland plain of central Pend Oreille Valley centered on Cusick and Usk is the



TOPOGRAPHIC DIAGRAM
PEND OREILLE
COUNTY



WASHINGTON CROP AND LIVESTOCK REPORTING SERVICE

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present primary agricultural region of the county. This plain is two to six miles in width and about 15 miles long, containing over 25,000 acres. Some sections of the plain around Calispell Lake to the southwest of Usk are poorly drained and are occasionally flooded by the Pend Oreille River. In the northern part of the county, the Pend Oreille Valley narrows into canyons and gorges. Box Canyon Dam was constructed a few miles downstream from Ione. Near the Canadian border the river flows through Z Canyon.

Numerous lakes and streams in the county add to the mountainous, scenic beauty. Outdoor recreation and tourism have become an important part of Pend Oreille County's economic life.

Climate

The climate of any region not only affects the pattern of flora native to the area but is a major determinant of what man shall grow there. Variations in weather may either stimulate or destroy crops in the process of development. For these obvious reasons, the relationship of climate and weather to agriculture is very close.

The climate of Pend Oreille County is a highland, continental type with local variations in temperatures and precipitation related to differences in elevation and exposure. The Rocky Mountains protect this area from the more severe winter storms moving southward across Canada and the Cascade Range obstructs the free movement of moist easterly air from over the Ocean. However, some cold air reaches this area through the north-south valley and the warmer moist air crossing the Cascades has a moderating influence. The county's climate, therefore, has some characteristics of both marine and continental types. Microclimatically, there is considerable difference between the climate in the valleys and the alpine climate in the higher elevations. Generally speaking, summers are dry and sunny with warm afternoons and cool nights; while winters are rather cold with considerable cloudiness and snow.

Temperature records from stations located in the valley show that the lowland area's average afternoon temperature in the summer is in the middle 80's and the nighttime temperature is in the upper 40's. In the cooler summers around Newport, maximum temperatures reach 90 degrees or higher on 5 to 15 days, while during the warmer summers 90 degrees or higher is recorded on 40 to 60 days. During July and August, maximum temperatures often reach 100 degrees and minimum temperatures drop to freezing on one or more days in approximately one-half of the summers. In northern Pend Oreille County at Metaline Falls, the number of days each summer with maximum temperatures above 90 degrees has ranged from 5 to 49 days.

The growing season in Pend Oreille County is shorter than in most parts of Washington. In the area around Newport, the average number of days between the last occurrence of 32 degrees in the spring and first in the fall is 65 days, and the occurrence of 28 degrees is 129 days. At Metaline Falls, the average number of days between the last occurrence of 32 degrees in the spring and the first in the fall is 133 days, and the occurrence of 28 degrees is 173 days. Several days' difference in the growing season can be expected within short distances. Risk of frost and winterkill discourages the planting of vegetables and fruit crops. Agriculture, therefore, is limited primarily to the growing of small grain crops, hay, pasture and the raising of livestock.

Table 5. Temperature Data
Average Maximum, Average Minimum, Mean, Highest and Lowest Temperature Each Month
Pend Oreille County, 1931-1960

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Metaline Falls (2157' elev.)	Av. Max.	30.0	37.8	46.2	58.2	68.9	73.9	84.2	82.0	74.6	57.9	39.6	32.7	57.2
	Av. Min.	16.9	21.3	25.1	31.6	39.6	45.5	48.8	47.4	41.3	35.0	27.0	22.3	33.5
	Mean	23.5	29.6	35.7	45.3	54.3	59.7	66.5	64.7	58.0	46.5	33.3	27.5	45.5
	Highest	48	57	71	87	95	97	104	100	96	87	57	55	104
	Lowest	-27	-28	-9	15	22	29	34	35	26	17	-6	-11	-28
Newport (2135' elev.)	Av. Max.	30.9	38.7	47.6	60.5	69.5	75.4	86.2	84.7	74.5	59.2	41.2	34.6	58.6
	Av. Min.	17.2	18.3	24.4	29.9	36.7	42.6	44.6	41.5	37.5	32.3	26.3	22.4	31.3
	Mean	24.0	28.5	36.0	45.2	53.1	59.0	65.4	63.1	56.0	45.8	33.8	28.5	44.9
	Highest	52	59	72	93	95	97	107	101	99	85	61	55	107
	Lowest	-41	-39	-14	6	17	26	30	27	11	-1	-14	-18	-41

Source: U. S. Weather Bureau, Climatological Office.

Table 6. Probability of Freezing Temperatures -- Pend Oreille County ^{1/}

STATION	TEMP. (° F.)	PROBABILITY -- SPRING					PROBABILITY -- FALL					Growing Season Mean Length (Days)
		90%	75%	50%	25%	10%	10%	25%	50%	75%	90%	
Metaline Falls	32	Apr 18	May 1	May 14	May 28	Jun 9	Sep 1	Sep 12	Sep 24	Oct 6	Oct 17	133
	28	Apr 1	Apr 14	Apr 27	May 10	May 22	Sep 24	Oct 5	Oct 17	Oct 30	Nov 8	173
	24	Mar 11	Mar 23	Apr 5	Apr 18	Apr 30	Oct 4	Oct 15	Oct 27	Nov 9	Nov 19	205
	20	Feb 23	Mar 7	Mar 21	Apr 3	Apr 15	Oct 21	Nov 1	Nov 13	Nov 25	Dec 6	237
	16	Feb 9	Feb 22	Mar 7	Mar 20	Apr 1	Nov 2	Nov 13	Nov 25	Dec 9	Dec 22	263
Newport	32	May 12	May 25	Jun 7	Jun 20	Jun 30	Jul 19	Jul 30	Aug 11	Aug 24	Sep 3	65
	28	Apr 20	May 3	May 16	May 29	Jun 10	Aug 30	Sep 10	Sep 22	Oct 4	Oct 15	129
	24	Apr 5	Apr 17	May 1	May 14	May 28	Sep 17	Sep 28	Oct 10	Oct 23	Nov 2	162
	20	Mar 17	Mar 29	Apr 12	Apr 25	May 9	Oct 3	Oct 15	Oct 27	Nov 9	Nov 18	198
	16	Feb 23	Mar 7	Mar 20	Apr 3	Apr 14	Oct 21	Nov 2	Nov 13	Nov 26	Dec 6	238

Source: U. S. Weather Bureau, Climatological Office.

^{1/} To illustrate the data in the table, we find that the 50 percent probability of a 32° spring freeze for Newport is June 7. But there is also a 25 percent chance (1 year in 4) that a 32° freeze will occur as late as June 20, and 10 percent chance as late as June 30.

In the winter season, the average afternoon temperature in the Pend Oreille River Valley is in the lower 30's and nighttime readings range from 12 to 20 degrees. Winters generally are colder in the Newport area than in the vicinity of Metaline Falls. Lowest temperatures generally occur when a high pressure area develops and cold air spills over the Rocky Mountains and reaches this section. Under these conditions, the sky is frequently clear and the ground covered with snow, thus a large amount of heat is lost by radiation at night. Minimum temperatures may range from zero to -25 degrees and maximum temperatures from 10 to 15 degrees. Within a few days after the invasion of such cold air into the area, warmer, moist air from over the Pacific may bring relief from the low temperatures. However, mixing of the moist air with the colder air results in considerable cloudiness and fog. Extreme temperatures of 41 degrees below zero have been recorded at Newport.

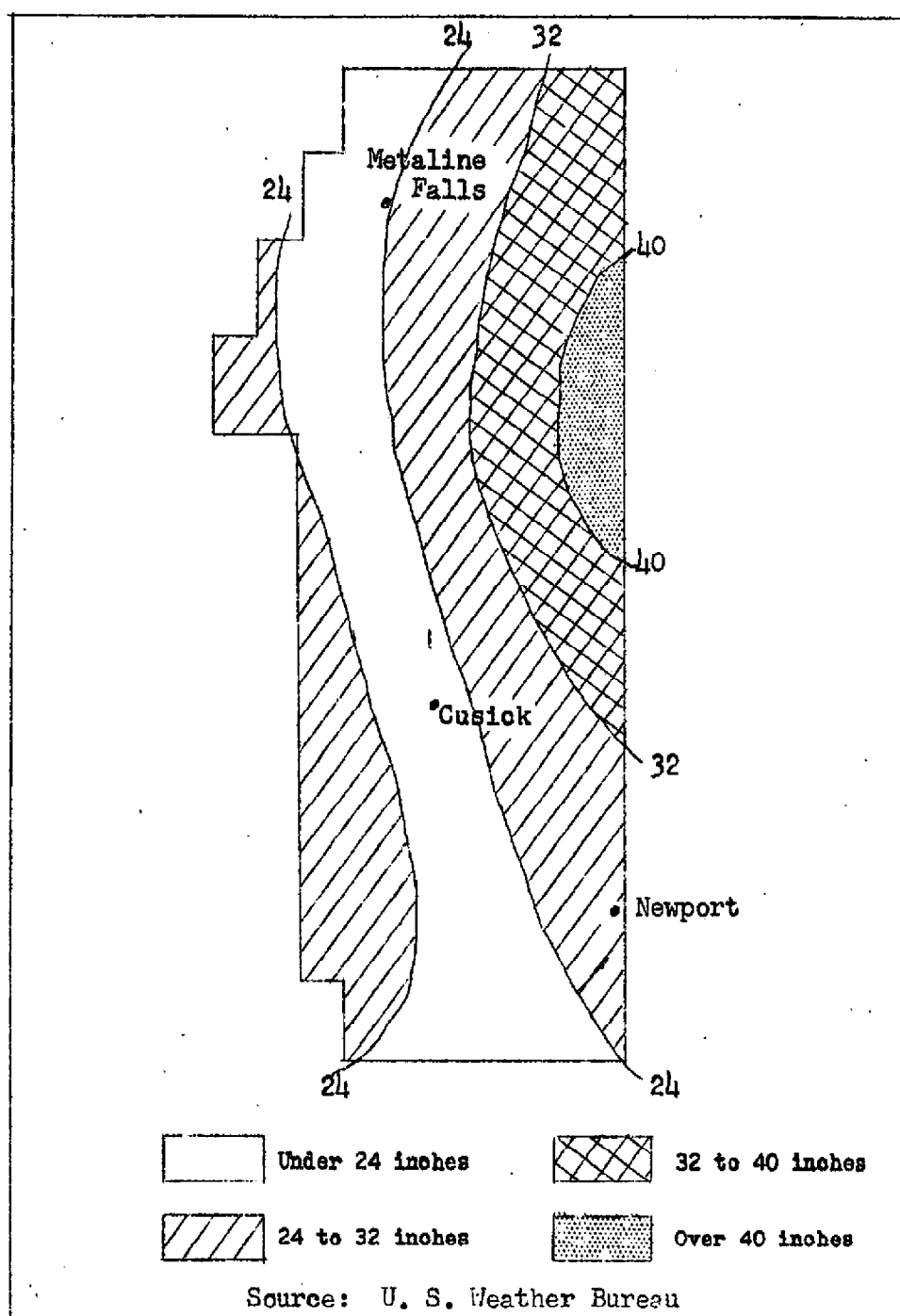


Figure 4. Distribution of Precipitation
Pend Oreille County

Precipitation in the county is least in the valley lowlands between the Okanogan Highlands and Selkirk Mountains and in the south-central section. The amount increases with elevation in both the western and eastern parts of the county. High ridges of the Selkirk Mountains, near the eastern county border, form the wettest zone with 40 inches and more.

Precipitation is light in the summer. Most of the precipitation falls in the winter. Summer rainfall is frequently associated with thunderstorms and numerous forest fires are started by lightning. Between mid-November and the first of March, most of the precipitation falls as snow. In the lower elevations, snow usually remains on the ground from mid-December until the last of February, reaching a depth of 10 to 20 inches in an average winter and 30 inches or more in heavier snowfall years. Snow can be expected in the higher elevations by the last of October or first of November and a snow cover usually remains on the ground there until the last of May or first of June. Snow survey reports available for elevations above 5,000 feet in this area indicate 6 to 8 feet of snow on the ground the first of April and 4 to 5 feet the first of May.

Table 7. Precipitation in Inches - Pend Oreille County

Station	Elevation (ft.)	Period of Record	Average Annual	Greatest Annual	Least Annual	Greatest Monthly	Least Monthly	Greatest Daily
Metalline Falls	2107	1942-60	28.42	35.99	19.69	7.97	Trace	2.27
Newport	2135	1931-60	27.16	37.49	16.24	8.25	Trace	2.24

Source: U. S. Weather Bureau, Climatological Office.

Table 8. Distribution of Precipitation by Months - Means
(inches)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Metalline Falls	3.14	2.48	2.08	1.76	2.32	2.98	1.40	1.30	1.46	3.10	3.13	3.27
Newport	3.50	2.65	2.48	1.71	1.99	1.89	.51	.80	1.47	2.76	3.51	3.79

Source: U. S. Weather Bureau, Climatological Office.

Forest and Wildlife

Forests dominate Pend Oreille County's landscape. In 1963, the U. S. Forest Service published the results of their latest survey which indicated that Pend Oreille's forest lands amounted to 843,000 acres--nearly 92 percent of the total county area. Commercial forests covered 812,000 acres while the remaining 31,000 acres involved unproductive or productive-reserved forests. Major species of commercial timber are Western White Pine, Douglas Fir, Western Larch, Western Red Cedar and Ponderosa Pine.

Two national forests--Kaniksu and Colville--cover about 60 percent of Pend Oreille County's commercial forest land. Nearly 29 percent of the commercial forest land is in private ownership including woodland owned by farmers. Another 6 percent is owned by the county's forest industry while the remaining 5 percent is in public ownerships other than national forests. In 1960, there was an estimated reserve of live sawtimber containing 4,163,000,000 board feet in the county.

In 1961, the timber harvest from the county was estimated at 62,476,000 board feet from 10,474 acres, according to the Washington State Department of Natural Resources. About 81 percent of the timber harvest was taken from U. S. Forest Service lands while the remaining 19 percent came off state and private lands. A large amount of timber and other forest products have come from farmlands. Census of Agriculture data indicate that forest products amounting to \$404,272 were sold off 187 county farms in 1959. About 32 percent or \$130,818 of the total farm sales represented standing timber.

Forest areas provide recreation, hunting and fishing for farmers as well as some income from packing and provisioning services for tourists and sportsmen. Forest lands also are used for grazing purposes by some livestockmen. Logging and lumbering are important to farm operators for part-time employment.

Washington State Department of Game statistics show a valuable harvest of animal resources from forests, streams, lakes and farmlands. In the 1962 season, 900 deer and 10 elk were bagged by hunters. The duck harvest in 1962 was 7,000 birds while geese numbered 600 and pheasants totaled 60. Many lakes and streams in Pend Oreille County are fair to good for sports fishing. In the 1962-1963 season, 3 trappers reported the following catch of fur-bearing animals: 162 muskrat, 55 mink, 3 raccoon, 6 skunk, 3 weasel and 1 bobcat.

Land Classification and Soils

The U. S. Soil Conservation Service has classified land use capability into eight broad classes. The first four classes include land which can be plowed and cultivated safely, without lasting damage, if correct conservation procedures are followed. Class I land needs little special conservation treatment. Classes II, III and IV require increasing degrees of care and protection. The remaining four classes are not suited for cultivation. They need protection afforded by a permanent cover of vegetation. Classes V, VI and VII require progressively more care even when used for grazing or forestry. Class VIII land can be used safely only for wildlife, recreation or watershed purposes. It has been determined that Pend Oreille County contains Classes II, III, IV, VI, VII and VIII lands and no Class I and V land. Variable pattern of land classes and soils between the county's mountains and lowland valleys has resulted from a combination of local differences in topography, drainage and climate.

Land suited for cultivation in Pend Oreille County is largely restricted to the Pend Oreille River lowlands. Class II lands with good to fair quality soils are found along the Pend Oreille River. Old glacial lake beds and recent river flood plains make up lands of this classification and are found mainly between Newport and Ione. The Cusick Flats contain the best agricultural lands in the county. Soils there are Springdale silt and clay loams of glacial origin which have been improved with drainage and fertilization. The clay contained in the glacial silt has created some problems for farming, being compact and heavy in structure and deficient in some minerals. Much cultivation, drainage and application of nitrogen, phosphate, lime and potash have improved its capability in more recent years.

Fringing the old lake beds of clay soils are benchlands and sloping foothills on both sides of the Pend Oreille Valley which are the Class III and IV lands. Soils are sandy and gravelly loams of varied depths belonging to the Colville, Clayton and Garrison series. These are derived from ancient alluvial material from melting glaciers and from organic matter deposited under a pine forest cover. These soils are thin, thus limiting their use to pastures and for woodland management.

The major portion of the county is in Class VI, VII and VIII lands. These hilly, mountainous lands are mantled by a thin layer of gravelly and rocky soils which support a cover of pine forest and grass. Some have been developed as pastures but these lands are nearly all in forest and range land.

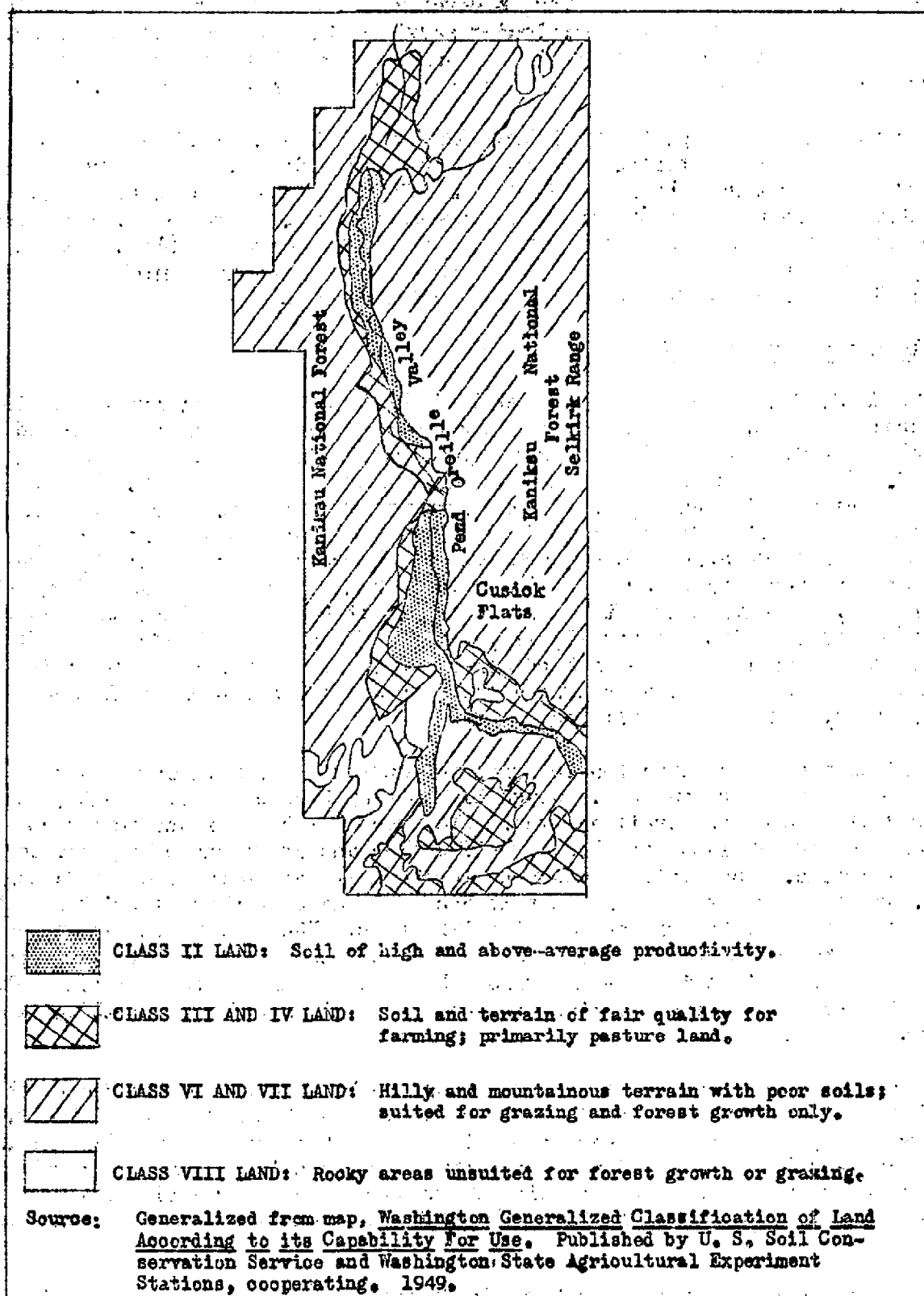


Figure 5. General Quality of Pend Oreille Land